REMARKS

Claims 1-6 and 13-18 are pending in the Application. Claims 1-6 and 18 are rejected under 35 U.S.C. § 103(a). Claims 13-17 are allowed. Applicants respectfully traverse these rejections for at least the reasons stated below and respectfully request the Examiner to reconsider and withdraw these rejections.

I. REJECTIONS UNDER 35 U.S.C. § 103(a):

The Examiner has rejected claims 1-4, 6 and 18 under 35 U.S.C. § 103(a) as being unpatentable over Chung et al. (U. S. Patent No. 6,184,142) (hereinafter "Chung") in view of Huang et al. (U.S. Patent No. 6,159,661) (hereinafter "Huang"). The Examiner has further rejected claim 5 under 35 U.S.C. §103(a) as being unpatentable over Chung in view of Huang and in further view of Yin et al. (U.S. Patent No. 6,573,175) (hereinafter "Yin"). Applicants respectfully traverse these rejections for at least the reasons provided below and respectfully request the Examiner to reconsider and withdraw these rejections.

A. Chung, Huang and Yin, taken singly or in combination, do not teach or suggest the following limitations.

Applicants respectfully assert that Chung, Huang and Yin, taken singly or in combination, do not teach or suggest "patterning a resist layer, the resist layer including a pattern having a plurality of apertures therein for etching a first portion of the first layer" as recited in claim 1 and similarly in claim 18. The Examiner cites resist layer 130 of Chung as teaching a resist layer including a pattern having a plurality of apertures. Paper No. 10, page 2. Applicants respectfully traverse and assert that resist layer 130 has a single aperture and not a plurality of apertures as illustrated in Figure 6A. Therefore, the Examiner has not presented a *prima facie* case of obviousness, since the Examiner is relying upon an incorrect, factual predicate in support of the rejection. *In re Rouffet*, 47 U.S.P.Q.2d 1453, 1455 (Fed. Cir. 1998).

Applicants further assert that Chung, Huang and Yin, taken singly or in combination, do not teach or suggest "removing said first resist layer utilizing a plasma etch after said first portion of said first layer is etched" as recited in claim 18. Instead, Chung (column 4, lines 49-54) teaches that the hole pattern of cap layer 114 is transferred into two low k organic layers 112 and 113 (where the Examiner asserts that low k organic dielectric layer 113 corresponds to a first layer cited in claim 18), including stop layer 116 after the photoresist layer 130 (the Examiner asserts that photoresist layer 130 corresponds to a first resist layer as recited in claim 18) is removed. Column 4, lines 44-54. That is, Chung teaches that photoresist layer 130 is removed prior not after the etching of layers 113, 116, 112 as illustrated in Figure 6C. Therefore, the Examiner has not presented a *prima facie* case of obviousness, since the Examiner is relying upon an incorrect, factual predicate in support of the rejection. *In re Rouffet*, 47 U.S.P.Q.2d 1453, 1455 (Fed. Cir. 1998).

Claims 2-6 each recite combinations of features including the above combinations, and thus are patentable for at least the above stated reasons. Claims 2-6 recite additional features, which, in combination with the features of the claims upon which they depend, are patentable over Chung in view of Huang and Yin.

For example, Chung, Huang and Yin, taken singly or in combination, do not teach or suggest "wherein the plasma further includes four percent of the forming gas" as recited in claim 4. The Examiner states that Chung in view of Huang do not teach the above-cited claim limitation. Paper No. 10, page 5. The Examiner further states:

> However, the selection of the percentage of the forming gas is obvious because it is a matter of determining optimum process condition by routine experimentation with a limited number of species. *In re Jones*, 162 U.S.P.Q. 224 (C.C.P.A. 1955) (the selection of optimum ranges within prior art general conditions is obvious) and *In re Boesch*, 205 U.S.P.Q. 215 (C.C.P.A. 1980) (discovery of optimum value of result effective variable in a known process is obvious). In such a situation, Applicants must show that the particular range is critical, generally by showing that the claim

> range achieved unexpected results. *See* M.P.E.P. § 2144.05 III. In fact, the originally filed Specification does not demonstrate any criticality and/or novelty as to why the forming gas has to be four percent. Paper No. 8, page 4.

The Examiner is misguided in relying upon *In re Jones* and *In re Boesch* as well as M.P.E.P. § 2144.05 to reject claim 4, as Chung and Huang do not teach any percentage of a forming gas. Instead, these cases stand for the proposition that when the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum workable ranges by routine experimentation. M.P.E.P. § 2144.05; *In re Aller*, 220 F.2d 454, 456, 105 U.S.P.Q. 233, 235 (C.C.P.A. 1955). Since the Examiner has not cited to any passage in Chung or Huang as teaching any percentage of a forming gas, the Examiner has not presented a *prima facie* case of obviousness for rejecting claim 4. M.P.E.P. 2144.05. Further, since the Examiner has not provided a *prima facie* case of obviousness based on overlapping ranges, Applicants do not have to rebut the Examiner's case by showing the criticality of plasma including four percent of the forming gas. M.P.E.P. § 2144.05 III. Thus, the Examiner's reliance upon *In re Jones* and *In re Boesch* as well as M.P.E.P. § 2144.05 for rejecting claim 5 is misguided.

Further, Applicants note that *In re Jones*, upon which the Examiner relies, precedes *Graham v. John Deere Co.*, 383 U.S. 1, 148 U.S.P.Q. 459 (1966). Accordingly, the holdings of *Graham* may overrule the holdings of *In re Jones*.

Therefore, the Examiner has not presented a *prima facie* case of obviousness for rejecting claim 4. M.P.E.P. § 2143.

As a result of the foregoing, Applicants respectfully assert that there are numerous claim limitations not taught or suggested in the cited prior art, and thus the Examiner has not presented a *prima facie* case of obviousness for rejecting claims 1-6 and 18.

B. By combining Chung with Huang, the principle of operation of Chung would change.

If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 U.S.P.Q. 349 (C.C.P.A. 1959). Further, if the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 U.S.P.Q. 1125 (Fed. Cir. 1984). For the reasons discussed below, Applicants submit that by combining Chung with Huang, the principle of operation in Chung would change and subsequently render the operation in Chung to perform its purpose unsatisfactorily.

Chung teaches a method for etching low k organic dielectric film in a semiconductor device that substantially avoids the complicated process flow from spin-on low k organic dielectric layer. Column 2, lines 32-36. Chung further teaches that two low k organic dielectric layers 112 and 113, stop layer 116 and cap layer 114 are formed using any suitable method. Column 4, lines 36-38. Chung further teaches that a hole pattern is transferred into photoresist layer 130 through exposure. Column 4, lines 41-42. Chung further teaches that the hole pattern of photoresist layer 130 is transferred into cap layer 114 by using a conventional dry etch method and in-situ the photoresist layer 130 is removed by using O_2 plasma treatment in the same etcher. Column 4, lines 44-48. Chung further teaches that the hole pattern of cap layer 114 is transferred into two low k organic layers 112 and 113 including stop layer 116 by using any suitable conventional anisotropic dry etch method. Column 4, lines 49-52. Chung further teaches that having formed hole pattern in dual damascene, a trench is next formed. Column 4, lines 55-56. Chung further teaches that another photoresist layer 131 is formed and imaged line patterns with prior conditions. Column 4, lines 56-57. Chung further teaches that the line patterns of

photoresist layer 131 is transferred into cap layer 114 by using a conventional dry etch method and in-situ the photoresist layer 131 is removed by O_2 plasma treatment in the same etcher. Column 4, lines 58-61.

Huang, on the other hand, teaches a dual damascene process that includes the step of first providing a semiconductor substrate that has a conductive layer already formed thereon, and then forming a first dielectric layer and a first mask layer sequentially over the conductive layer. Column 3, lines 7-10. Huang further teaches that a first silicon oxynitride (SiON) layer is formed over the first mask layer. Column 3, lines 12-14. Huang further teaches that thereafter, photolithographic and etching operations are carried out to pattern the first silicon oxynitride layer, and then etch the first mask layer using the first silicon oxynitride as a mask thereby exposing a portion of the first dielectric layer. Column 3, lines 14-18. Huang further teaches that subsequently a second dielectric layer is formed over the first silicon oxynitride so that the first dielectric layer and the second dielectric layer are connected. Column 3, lines 18-20. Huang further teaches that next, a second mask layer and a second silicon oxynitride layer are sequentially formed over the second dielectric layer. Column 3, lines 23-25. Huang further teaches that thereafter, another set of photolithographic and etching operations is conducted to pattern the second silicon oxynitride layer, and then the second mask layer is etched using the second silicon oxynitride layer as a mask. Column 3, lines 25-28. Huang further teaches that next, using the second mask layer as a mask, the second dielectric layer is etched to form a metal wire opening that exposes the first dielectric layer. Column 3, lines 28-31. Huang further teaches that thereafter etching is continued down the metal wire opening forming a via opening in the first dielectric layer that exposes the conductive layer. Column 3, lines 31-33. Huang further teaches that metal is deposited into the metal wire opening and the via opening to form a dual damascene structure. Column 3, lines 33-35.

By combining the damascene process, as taught in Chung, with the dual damascene process, as taught in Huang, Chung would no longer be able to etch low k organic dielectric film in a semiconductor device that substantially avoids the complicated process flow from spin-on low k organic dielectric layer. Huang only teaches one low k organic dielectric; whereas, Chung teaches having two low k organic dielectrics. Further, Huang does not teach a stop layer; whereas, Chung teaches a stop layer in between the two low k organic dielectrics. Hence, Chung would no longer be able to etch low k organic dielectric film which is the purpose of the operation of Chung. Thus, by combining Chung with Huang, the principal of operation in Chung would change, essentially render the operation of Chung to perform its purpose unsatisfactorily. Therefore, the Examiner has not presented a *prima facie* case of obviousness for rejecting claims 1-6 and 18. *In re Ratti*, 270 F.2d 810, 123 U.S.P.Q. 349 (C.C.P.A. 1959); *In re Gordon*, 733 F.2d 900, 221 U.S.P.Q. 1125 (Fed. Cir. 1984).

C. The Examiner has not presented any objective evidence for combining Chung, Huang and Yin.

A *prima facie* case of obviousness requires the Examiner to establish, *inter alia*, that the prior art references teach or suggest, either alone or in combination, all of the limitations of the claimed invention, and the Examiner must provide a motivation or suggestion to combine or modify the prior art reference to make the claimed inventions. M.P.E.P. §2142. The showings must be clear and particular. *In re Lee*, 277 F.3d 1338, 1343, 61 U.S.P.Q.2d 1430, 1433-34 (Fed. Cir. 2002); *In re Kotzab*, 217 F.3d 1365, 1370, 55 U.S.P.Q.2d 1313, 1317 (Fed. Cir. 2000); *In re Dembiczak*, 50 U.S.P.Q.2d 1614, 1617 (Fed. Cir. 1999). Broad conclusory statements regarding the teaching of multiple references, standing alone, are not evidence. *Id.*

The Examiner's motivation for modifying Chung and Huang with Yin to provide a wet preclean after performing a plasma etch using a plasma including a forming gas, as recited in claim 5, is to "clean the residues from the plasma etching;

which, in turn, would benefit the critical dimension of the device." Paper No. 10, page 6. This motivation is insufficient to support a *prima facie* case of obviousness as discussed below.

The Examiner's motivation appears to have been gleaned from the secondary reference (Yin). In fact, the Examiner directly quotes from column 5, lines 30-37 of Yin as support for his motivation. Paper No. 10, pages 5-6. This is not evidence as to why one of ordinary skill in the art with the primary reference, Chung, in front of him would have been motivated to modify Chung with the teachings of the secondary reference, Yin. The Examiner's motivation is motivation for the secondary reference, Yin, to solve its problem. This is not a suggestion to combine the primary reference, Chung, with the secondary references, Huang and Yin. The Examiner must provide evidence as to why one of ordinary skill in the art with Chung in front of him, which teaches a method for etching low k organic dielectric film (Abstract of Chung), would be motivated to modify Chung with the teachings of Yin, which teaches methods of selectively removing post-etch polymer material and dielectric antireflective coatings (DARC) without substantially etching an underlying carbon-doped low k dielectric layer (Abstract of Yin). *See In re Lee*, 61 U.S.P.Q.2d 1430, 1433-1434 (Fed. Cir. 2002); *In re Kotzab*, 55 U.S.P.Q.2d 1313, 1318 (Fed. Cir. 2000). Merely stating what the secondary reference teaches is not evidence for combining a primary reference, Chung, with the secondary references, Huang and Yin. *See Id.* Consequently, the Examiner's motivation is insufficient to support a *prima facie* case of obviousness for rejecting claim 5. *In re Lee*, 61 U.S.P.Q.2d 1430, 1434 (Fed. Cir. 2002).

Further, the Examiner must submit objective evidence and not rely on his own subjective opinion in support of combining Chung, which teaches a method for etching low k organic dielectric film, with Yin, which teaches methods of selectively removing post-etch polymer material and dielectric antireflective coatings without substantially etching an underlying carbon-doped low k dielectric layer. *Id.* There is no suggestion in Chung of removing post-etch polymer material. Neither is there any

suggestion in Chung of removing dielectric antireflective coatings. Neither is there any suggestion in Chung of removing post-etch polymer material and dielectric antireflective coatings without substantially etching an underlying carbon-doped low k dielectric layer. Since the Examiner has not submitted objective evidence for modifying Chung with Yin, the Examiner has not presented a *prima facie* case of obviousness for rejecting claim 5. *Id.*

Further, the Examiner must submit objective evidence and not rely on his own subjective opinion in support of modifying Chung to provide a wet preclean after performing a plasma etch using a plasma including a forming gas (Examiner admits that Chung does not teach this limitation). There is no suggestion in Chung of providing a wet preclean. Neither is there any suggestion in Chung of providing a wet preclean after performing a plasma etch using a plasma including a forming gas. Since the Examiner has not submitted objective evidence for modifying Chung to provide a wet preclean after performing a plasma etch using a plasma including a forming gas, the Examiner has not presented a *prima facie* case of obviousness for rejecting claim 5. *Id.*

As a result of the foregoing, Applicants respectfully assert that the Examiner has not presented a *prima facie* case of obviousness for rejecting claim 5. M.P.E.P. §2143.

D. By combining Chung with Yin, the principle of operation of Chung would change.

As stated above, if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 U.S.P.Q. 349 (C.C.P.A. 1959). Further, if the proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 U.S.P.Q. 1125

(Fed. Cir. 1984). For the reasons discussed below, Applicants submit that by combining Chung with Yin, the principle of operation in Chung would change and subsequently render the operation in Chung to perform its purpose unsatisfactorily.

As stated above, Chung teaches a method for etching low k organic dielectric film in a semiconductor device that substantially avoids the complicated process flow from spin-on low k organic dielectric layer. Column 2, lines 32-36. Chung further teaches that two low k organic dielectric layers 112 and 113, stop layer 116 and cap layer 114 are formed using any suitable method. Column 4, lines 36-38. Chung further teaches that a hole pattern is transferred into photoresist layer 130 through exposure. Column 4, lines 41-42. Chung further teaches that the hole pattern of photoresist layer 130 is transferred into cap layer 114 by using a conventional dry etch method and in-situ the photoresist layer 130 is removed by using O_2 plasma treatment in the same etcher. Column 4, lines 44-48. Chung further teaches that the hole pattern of cap layer 114 is transferred into two low k organic layers 112 and 113 including stop layer 116 by using any suitable conventional anisotropic dry etch method. Column 4, lines 49-52. Chung further teaches that having formed hole pattern in dual damascene, a trench is next formed. Column 4, lines 55-56. Chung further teaches that another photoresist layer 131 is formed and imaged line patterns with prior conditions. Column 4, lines 56-57. Chung further teaches that the line patterns of photoresist layer 131 is transferred into cap layer 114 by using a conventional dry etch method and in-situ the photoresist layer 131 is removed by O_2 plasma treatment in the same etcher. Column 4, lines 58-61.

Yin, on the other hand, teaches a wafer fragment 10 that comprises a substrate 12, a conductive (active) area 14, an overlying interlayer dielectric (ILD) layer 16 and an overlying dielectric /anti-reflective coating (DARC) layer 18. Column 3, lines 54-57. Yin further teaches forming photoresist layer 20 over DARC layer 18. Column 5, lines 1-3. Yin further teaches patterning and etching ILD layer 16 and DARC layer

18 to form via 22 and trench 24. Column 5, lines 11-15. Yin further teaches that once the etch stop and photoresist strip are completed, a post-etch cleaning is performed using a single step wet etch to selectively remove the DAR layer 18 and any remaining post-etch polymer. Column 5, lines 30-33.

By combining the damascene process, as taught in Chung, with the methods for removing post-etch polymer material and dielectric antireflective coatings, as taught in Yin, Chung would no longer be able to etch low k organic dielectric film in a semiconductor device that substantially avoids the complicated process flow from spin-on low k organic dielectric layer. Yin only teaches a single low k organic dielectric (interlayer dielectric layer 16); whereas, Chung teaches having two low k organic dielectrics. Further, Yin does not teach a stop layer; whereas, Chung teaches a stop layer in between the two low k organic dielectrics. Hence, Chung would no longer be able to etch low k organic dielectric film which is the purpose of the operation of Chung. Thus, by combining Chung with Yin, the principal of operation in Chung would change, essentially render the operation of Chung to perform its purpose unsatisfactorily. Therefore, the Examiner has not presented a *prima facie* case of obviousness for rejecting claim 5. *In re Ratti*, 270 F.2d 810, 123 U.S.P.Q. 349 (C.C.P.A. 1959); *In re Gordon*, 733 F.2d 900, 221 U.S.P.Q. 1125 (Fed. Cir. 1984).

II. ALLOWABLE SUBJECT MATTER:

Applicants appreciate the allowance of claims 13-17. Paper No. 10, page 6.

III. CONCLUSION:

As a result of the foregoing, it is asserted by Applicants that claims 1-6 and 13-18 in the Application are in condition for allowance, and Applicants respectfully request an allowance of such claims. Applicants respectfully request that the Examiner call Applicants' attorney at the below listed number if the Examiner believes that such a discussion would be helpful in resolving any remaining issues.

Respectfully submitted,

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